



॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ
मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या व्होकेशनल कोर्सेसचे (बी.व्होक पदवी, अँडव्हॉस डिप्लोमा, डिप्लोमा व सर्टिफिकेट) अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१ पासून लागू करणे बाबत.

परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या व्होकेशनल कोर्सेसच्या (बी. व्होक पदवी, अँडव्हॉस डिप्लोमा, डिप्लोमा व सर्टिफिकेटस) अभ्यासक्रमांना मा. विद्यापरिषदेच्या दिनांक २१ सप्टेंबर २०२१ रोजीच्या बैठकीतील विषय क्रमांक ५/५२-२०२१ च्या ठरावानुसार C.B.C.S. (Choice Based Credit System) Pattern नुसारचा खालील अभ्यासक्रमांस मान्यता देण्यात आली आहे.

1. B. Voc. Chemical & Petrochemicals Applied Analytical Chemistry. I year
2. B. Voc. Degree in Dairy Technology I year
3. B. Voc. Degree in Dairy Farming I year
4. Certificate Course in Dairy Processing Equipement operator.

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

जा.क्र.:शैक्षणिक-१/परिपत्रक/व्होकेशनल अभ्यासक्रम/N-
२०२०-२१/१५१

दिनांक : ०४.१०.२०२१

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. मा अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

स्वाक्षरित

सहा.कुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

**Swami Ramanand Teerth Marathwada
University, Nanded**



**Syllabus for the
First Year Bachelor of Vocation (Sem I & II)**

**Program: B.Voc.
(UGC Recognized)**

**Course Title: “Chemicals & Petrochemicals
Applied Analytical Chemistry”**
(Credit Based Semester and Grading System
with effect from the academic year 2020–2021)

Faculty – Science & Technology

-: Preamble:-

B.Voc. is introduced with the needs of the economy so as to ensure that the graduates of higher education system have adequate knowledge and skill for employment and entrepreneurship. The higher education system has to incorporate the requirements of various industries in its curriculum, in an innovative and flexible manner while developing a holistic and well-groomed graduate.

The University Grants Commission (UGC) has launched a scheme on skill development based higher education as part of college/university education, leading to Bachelor of Vocation (B.Voc.) Degree with multiple exits such as Diploma / Advanced Diploma under the NSQF. The B.Voc. programme is focused on universities and colleges providing undergraduate studies which would also incorporate specific job roles and their NOSs along with broad based general education. This would enable the graduates completing B.Voc. to make a meaningful participation in accelerating India's economy by gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge.

Objectives

- To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- To provide vertical mobility to students coming out of 10+2 with vocational subjects.

Levels of Awards

The certification levels will lead to Diploma/Advanced Diploma/B. Voc. Degree in one or more vocational areas and will be offered under the aegis of the University. Award Duration Corresponding NSQF level

- Diploma 1 Year
- Advanced Diploma 2 Years
- B.Voc. Degree 3 Years

Eligibility and Fees for Admission in B.Voc.

The eligibility condition for admission to B.Voc. programme shall be 10+2 or equivalent, in any stream.

**SwamiRamanand Teerth Marathwada University, Nanded Bachelor of
Vocation (B.Voc.) (Applied Analytical Chemistry)
Syllabus for the Year: 2020 – 21**

| | Paper No. | Course Number | Course Title | Hr/Week | Type of Course | Credits | Marks | | Total |
|------------------------------------|------------------------------------|---------------|---|--------------|----------------|----------------|---------|-------|-------|
| | | | | | | | ESA | CIA | |
| Sem. I | General Education Component | | | | | | | | |
| | Paper-I | CPAC-01 | Communication Skills | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-II | CPAC -02 | Basic Computers | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-III | CPAC-03 | Basics of Analytical Chemistry | 4 | GE | 4 | 75 | 25 | 100 |
| | Skill Courses | | | | | | | | |
| | Paper-IV | CPAC-04 | Laboratory Course-I | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper-V | CPAC-05 | Laboratory Course-II | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper-VI | CPAC-06 | Laboratory Course-III | 6 | CC | 6 | 100 | 50 | 150 |
| | Sem. II | Paper No. | Course Number | Course Title | Hr/Week | Type of Course | Credits | Marks | |
| General Education Component | | | | | | | | | |
| Paper-VII | | CPAC-07 | Basic Organic Chemistry | 4 | GE | 4 | 75 | 25 | 100 |
| Paper-VIII | | CPAC-08 | Miscellaneous Method of Analysis | 4 | GE | 4 | 75 | 25 | 100 |
| Paper-IX | | CPAC-09 | Petrochemistry | 4 | GE | 4 | 75 | 25 | 100 |
| Skill Courses | | | | | | | | | |
| Paper-X | | CPAC-10 | Laboratory Course-IV | 6 | CC | 6 | 100 | 50 | 150 |
| Paper-XI | | CPAC-11 | Laboratory Course-V | 6 | CC | 6 | 100 | 50 | 150 |
| Paper-XII | | CPAC-12 | Laboratory Course-VI | 6 | CC | 6 | 100 | 50 | 150 |
| Sem. III | Paper No. | Course Number | Course Title | Hr/Week | Type of Course | Credits | Marks | | Total |
| | General Education Component | | | | | | | | |
| | Paper-XIX | CPAC-13 | S & P block element | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-XX | CPAC-14 | Methods of Analysis | 4 | GE | 4 | 75 | 25 | 100 |

| | | | | | | | | | |
|------------------------------------|------------------------------------|----------------------|----------------------------|----------------|-----------------------|----------------|--------------|------------|--------------|
| | Paper-XXI | CPAC-15 | Basics of Biochemistry | 4 | GE | 4 | 75 | 25 | 100 |
| | Skill Courses | | | | | | | | |
| | Paper-XXII | CPAC-16 | Laboratory Course-VII | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper-XXIII | CPAC-17 | Laboratory Course-VIII | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper-XXIV | CPAC-18 | Laboratory Course-IX | 6 | CC | 6 | 100 | 50 | 150 |
| Sem. IV | Paper No. | Course Number | Course Title | Hr/Week | Type of Course | Credits | Marks | | Total |
| | | | | | | | ESA | CIA | |
| | General Education Component | | | | | | | | |
| | Paper-XXVIII | CPAC-19 | d & f block element | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-XXIX | CPAC-20 | Petrochemistry -II | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-XXX | CPAC-21 | Method of Analysis | 4 | GE | 4 | 75 | 25 | 25 |
| | Skill Courses | | | | | | | | |
| | Paper-XXXI | CPAC-22 | Laboratory Course-X | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper-XXXII | CPAC-23 | Laboratory Course-XI | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper-XXXIII | CPAC-24 | Laboratory Course-XII | 6 | CC | 6 | 100 | 50 | 150 |
| Sem. V | Paper No. | Course Number | Course Title | Hr/Week | Type of Course | Credits | Marks | | Total |
| | | | | | | | ESA | CIA | |
| | General Education Component | | | | | | | | |
| | Paper-XXXVII | CPAC-25 | Analytical spectroscopy | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-XXXVIII | CPAC-26 | Analytical Instrumentation | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-XXXIX | CPAC-27 | Petrochemistry-III | 4 | GE | 4 | 75 | 25 | 25 |
| | Skill Courses | | | | | | | | |
| | Paper-XXXX | CPAC-28 | Laboratory Course-XIII | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper-XXXXI | CPAC-29 | Laboratory Course-XIV | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper-XXXXII | CPAC-30 | Laboratory Course-XV | 6 | CC | 6 | 100 | 50 | 150 |
| | Paper No. | Course Number | Course Title | Hr/Week | Type of Course | Credits | Marks | | Total |
| | | | | | | | ESA | CIA | |
| General Education Component | | | | | | | | | |

| | | | | | | | | | |
|--------------------|----------------------|---------|---|---|----|----|-----|-----|-----|
| Sem. VI | Paper-XXXXVI | CPAC-31 | Production and Quality control | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-XXXXVII | CPAC-32 | Human Resource Management | 4 | GE | 4 | 75 | 25 | 100 |
| | Paper-XXXXVIII | CPAC-33 | Field Visit/ Industrial Visit | 4 | GE | 4 | -- | 100 | 100 |
| | Skill Courses | | | | | | | | |
| | Paper-XXXXIX | AAC-34 | Industrial Project at Chemical based Industries | - | CC | 16 | 300 | 100 | 400 |
| | Paper-XXXXX | CPAC-35 | Report Writing | - | CC | 2 | 25 | 25 | 50 |
| | Paper-XXXXXI | CPAC-36 | Seminar and Viva-Voce | - | CC | 3 | 75 | - | 75 |

Note: Project/Industrial training and report writing is compulsory

Semester - I

Swami Ramanand Teerth Marathwada University, Nanded
Certificate, Diploma, Advanced Diploma and B.Voc Degree
(Chemical & Petrochemicals Applied Analytical Chemistry)

First Year (Semester I) Semester Pattern

Paper-I: Communication Skills (CPAC-01)

Maximum Marks: 100

Credits: 4

Periods: 45

Unit I: Basic Grammar: (13 Periods)

Introduction, Grammar Word Classes (Open & Closed), Sentence – Kinds – Transformation, Phrase, Clause and its kinds, Simple, Complex & Compound sentences, (Only definitions & Structure), Tenses - Use of verbs in the Sentences

Unit II: Vocabulary: (10 Periods)

Morphology, Synonyms & Antonyms, One Word Substitution, Homophones & Homonyms

Unit III: Communication Skills: (10 Periods)

Definition & Types, Communication Cycle & Barriers, Principles for Effective Communication, Varieties in English (Indian, British & American).

Unit IV: Writing Skills: (12 Periods)

Letters (Formal & Informal), Report Writing (Scientific and Formal), Memorandum, Curriculum Vitae, Personal Employment Interview, Group Discussion. Phonetics: 44 sounds, consonants, vowels & Diphthongs, Transcription of words, Accent, Syllable cluster and Intonation.

Reference Books:

1. Developing of Communication Skills -Krishna Mohan & Meera Banerji
2. A Practical English Grammar A.J. Thomson –Oxford
3. Mastering English Grammar – S.H.Burton
4. Technical Communication- Raman Sharma- Oxford
5. Written Communication in English – Sarah Freeman Orient Longman Pvt. Ltd.
6. A Course in Phonetics & Spoken English -J.Sethi & P.V.Dhamija
7. Radiance-Tense

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**Certificate, Diploma, Advanced Diploma and B.Voc Degree
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First Year (Semester I) Semester Pattern

Paper-II Basics of Computer (CPAC-02)

Maximum Marks: 100

Credits: 4

Periods-45

Unit I: Basics of Computer: (10 Periods)

Introduction to computer, Definition and Types. Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply.

Unit II: Computer Operation: (13 Periods)

Operating Computer using GUI Based Operating System: What is an Operating System; Basics of Popular Operating Systems; The User Interface, Using Mouse; Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Running an Application, Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows;

Unit III: MS-Office: (10 Periods)

Introduction to MS-Word: Word Processing Basics; Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document. MS- Excel, Power Point. Internet concept & definition, WWW, URL, http, Browsers, Search engines etc.

Unit IV: Computer Networking: (12 Periods)

Basic of Computer networks; LAN, MAN, WAN; Concept of Internet; Applications of Internet. Communications and collaboration: Basics of electronic mail; Getting an email account; Sending and receiving emails; Accessing sent emails; Using Emails; Document collaboration; Instant Messaging; Netiquettes.

Reference Books:

1. Introduction of Computer Science- Pcushman & R. Mata Toledo, McGraw Hill
2. Computer fundamentals – P.K. Sinha – BPB New Delhi.
3. Microsoft Office – 2000Complete – BPB Practicals

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First Year (Semester I) Semester Pattern
Paper-III Basics of Analytical Chemistry (CPAC-03)

Maximum Marks: 100

Credits: 4

Periods-45

1.Errors, Statistics and Sampling (10 Periods)

Accuracy and precision, Error, types of error, systematic and random errors, minimization of errors, mean and standard deviations, reliability of results, confidence interval, comparison of results, student T test, F test, Comparison of two samples (Paired T test), correlation and regression, correlation coefficient and liner regression, Sampling , the basis of sampling, sampling procedure, sampling statistics.

2 .Acid Base Equilibria and Buffer Solutions (10 periods)

Acid-base theories, Definition of pH and pH scale (Sorenson and operational definitions), and its significance, Hammett acidity function, pH at elevated temperatures, pH for aqueous solutions of very weak acid and base, pH for salts of weak acid and weak bases, polyprotic acids. Buffer solutions, buffer capacity, applications of buffers, Physiological buffers, buffers for biological and clinical measurements.

3.Mole Concept and Oxidation-reduction (10 periods)

Mole concept-Determination of mol. Weight by gram molecular volume relationship, problems based on mole concept. Methods of expressing concentrations, strength, normality, molarity, molality, %w/v, %v/v, ppm, standardization of solutions, primary & secondary standard substances, Preparation of standard solution of acids & bases, problems related to acid base titrations only. Oxidation & reductionDefinitions to related terms like oxidation, reduction, oxidizing agent, reducing agent, oxidation number, Balancing of redox reactions using oxidation number method & ion electron method, problems based one equivalent weight of oxidant & reductants

Chromatography (10 periods)

Introduction and classification of chromatographic methods, Principle of chromatographic analysis with match box model, Theoretical plates and column efficiency, Theory, Principle, Technique and applications of Column Chromatography, Ion exchange Chromatography, Thin layer Chromatography, Paper Chromatography.

Other chromatographic techniques: (5 periods)

Ion-exchange, ion-pair, affinity, size exclusion, chiral and super critical fluid chromatography: Principle, material used, application in the analysis.

References:

1. Essentials of Physical Chemistry by B.S. Bahl, G.D.Tuli and ArunBahl Edition 2000
S. Chand and Company Ltd
2. Principles of Physical Chemistry, Fourth Edition by S.H. Marron and C. F. Pruton
3. Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar
4. Analytical Chemistry by Skoog
5. Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel
6. Vogel's textbook of Quantitative Inorganic Analysis-4th edition
Instrumental Methods of Chemical Analysis- Chatwal and Anand

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First Year (Semester I) Semester Pattern
Paper-IV: Laboratory Course-I (CPAC-04)

Maximum Marks: 150

Credits: 6

Periods-90

Introduction to Chemical Laboratory, Precautions and general safety measures.

General procedure to run the TLC (Thin layer chromatography)

Preparation of Molar and Normal Solutions of acidic and basic compounds.

Determination of ferrous ammonium sulfate potentiometrically with standard ceric sulfate solution (Direct and back titration).

Determination of concentration of halide ion(s) in the given solution potentiometrically.

Determination of concentration of Fe ion in ferric salicylate complex spectrophotometrically.

To Prepare and standardize 0.1 N HCL using sodium carbonate as a primary standard.

To determine sodium carbonate content of washing soda. Spectrophotometric determination of pK value of an indicator.

Introduction to Laboratory Techniques Calibration of thermometer, Melting point, Boiling Point & distillation and Crystallization.

Determination of Physical Constants of Solid Organic Compounds.

Determination of Physical Constants of Liquid Organic Compounds.

UV visible ,IR,PMR ,CMR mass spectrum of organic and inorganic compounds.

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First Year (Semester I) Semester Pattern
Paper-V: Laboratory Course-II (CPAC-05)

Maximum Marks: 150

Credits: 6

Periods-90

Determination of moisture content in organic compounds using Karl-Fischer method.

To estimation of iron from the given tablet.

Determination of λ max of given compounds.

Determination of normality of given HCl and CuSO₄.

To determine amount of Paracetamol in tablet.

Estimation of carbohydrates by Anthrone method.

Determination of hardness of water from a given sample of water by EDTA method.

Determination of Glucose from Glucone -D By titration with Fehling solution.

Isolation of caffeine from tea powder.

Identification of Organic Compounds by using Paper Chromatography.

Identification of Polar & Non-Polar Organic Compounds by using Thin Layer Chromatography.

Study the hydrolysis of ammonium chloride or sodium acetate or aniline,hydrochloride conductometrically.

Monitoring of nitration of organic compound by gas chromatography.

Analysis of binary mixture of simple organic compound by HPLC method.

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First Year (Semester I) Semester Pattern
Paper-VI: Laboratory Course-III (CPAC-06)

Maximum Marks: 150

Credits: 6

Periods-90

Project/Industrial Training or Visit

Tentative topic for projects

Projects to be based upon convenient analytical protocol for analysis of one of the following materials

- 1) Drugs / Medicines
- 2) Dyes / Paints /cosmetics
- 3) Milk products / vegetable oil /Beverages
- 4) Plastics & polymers
- 5) Ores & alloys
- 6) Fertilizer, insecticide , pesticides ,plant material analysis
- 7) Environmental samples ,air, water ,soil

Project / Industrial tour report Frame

- 1) Literature survey
- 2) Experimental procedures ,photographs
- 3) Characterizations techniques : fundamentals principles of respective techniques
- 4) Spectrum / images of prepared materials
- 5) Data analysis / application of synthesized materials
- 6) Conclusion
- 7) Reference citation
- 8) Holistic response of students (scientific thinking ,power of imagination , punctuality, efforts, curiosity)

Power point Presentation of project work

- 1) Self preparation PPT
- 2) Skill of presentation
- 3) Contents of presentation
- 4) Subject knowledge
- 5) Manuscript preparation / acceptance / publication

Reference : Internet search

References:

- 1) Intermediate English Grammar- Raymond Murphy (Cambridge University Press, 1999)
- 2) Advanced Grammar in Use- Martin Hewings (Cambridge University Press, 2001)
- 3) Longman Dictionary of Common Error-, N. D Turton, J. B Heaton (Pearson, 2004)
- 4) Mathematical preparation of Physical Chemistry by F. Daniel, Mc Graw Hill Publication
- 5) Environmental Chemistry-A.K.De 5th Edⁿ
- 6) Environmental Chemistry-J. W. Moore & E.A. Moore
- 7) Essentials of Physical Chemistry by B.S. Bahl, G.D.Tuli and ArunBahl Edition 2000 S. Chand and Company Ltd

- 8) Principles of Physical Chemistry, Fourth Edition by S.H. Marron and C. F. Pruton
- 9) Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar
- 10) Analytical Chemistry by Skoog
- 11) Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel
- 12) Vogel's textbook of Quantitative Inorganic Analysis-4th edition
- 13) Guidance for Industry – Good Laboratory Practices

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Certificate, Diploma, Advanced Diploma and B.Voc Degree
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First Year (Semester II) Semester Pattern
Paper-VII Basics Organic Chemistry (CPAC-07)

Maximum Marks: 100

Credits: 4

Periods: 45

Introduction to Organic Chemistry (8periods)

Development of organic chemistry, unique Properties of organic compounds, Sources of organic compounds, applications of organic compounds. Functional groups and their reaction, preparation, properties & uses .

Structure & Bonding in organic Molecules (10 Periods)

Covalent bond, Hybridization in organic molecules (sp^3 , sp^2 , sp), bond length, bond angles, bond energies, localized & delocalized chemical bond, vander Waal's interactions, Inter & Intra molecular forces & their effects on physical properties, Structural effects like inductive, Resonance, Hyper conjugation, steric effect, Hydrogen bounding.

Isomerism in organic compounds (15 periods)

Concept of isomerism, type, (Structural chain, position, functional group), Representation of organic, Molecules – Zig- Zag structures, projection formulae – (Saw horse (Andiron), Newman, Fisher & Dotted – wedge), Conformational isomerism in alkanes, free rotation about carbon- carbon single bond, conformation of ethane, propane n, butane , relative stability of different conformations, Optical isomers – Isomer number & tetrahedral carbon atom chirality, optical isomerism with one asymmetric carbon atom, Polarimeter, Specific rotation, Enantiomerism R & S Nomenclature, Geometrical isomerism – Definition, conditions for geometrical isomerism, cis-trans & E-Z nomenclature, physical & chemical properties of geometrical isomerism.

Polymer Chemistry (12 Periods)

| | |
|--|---|
| | |
| | Classification of Polymer: Organic and Inorganic Polymers a) Basic concepts, nomenclature, degree of polymerization, classification of polymerization reactions, thermodynamics and transport properties of polymer. b) Nylon, polyesters (terylene and dacron), rubber, vulcanization of rubber, synthetic rubber, Bun 2-N rubber, copolymers of butadiene, PVC, acrylic Teflon, polyethylene and acrylonitrile c) Silicone polymers: silicone oils, rubber, grease and resin d) Resins: Phenol-formaldehyde resins, urea-formaldehyde resins, epoxy resins, melamine-formaldehyde resins. |

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First Year (Semester II) Semester Pattern
Paper-VIII: Miscellaneous Method of Analysis (CPAC-08)

Analysis of Organic Compounds (Qualitative & Quantitative) (10 Periods)**I. Qualitative**

Types of organic compounds, Characteristic tests and classifications, reactions of different functional groups, analysis of binary mixtures.

II Quantitative

Analysis–estimation of C, H, (O) by combustion tube, detection of nitrogen, sulfur, halogen and phosphorous by Lassigen’s test.

Estimation of nitrogen by Dumas’s Kjeldahl’s method, estimation of halogen, sulphur and phosphate by Carious method.

Determination of empirical and molecular formula, numerical problems

Introduction to volumetric analysis Introduction, methods of expressing concentrations, primary and secondary standard solutions. Apparatus used and their calibration: burettes, microburettes, volumetric pipettes, graduated pipettes, volumetric flask, methods of calibration, Instrumental & non instrumental analysis – principles & types

Introduction ,Basic principle , instrumentation ,operational procedures & Applications in analysis of following techniques (15 Periods)

1. pH metry
2. conductometry
3. Potentiometry
4. Flurometry
5. Refractometry

Non-Instrumental volumetric analysis (10 Periods)

Indicators–theory of indicators, acid base indicators, mixed and universal indicators.

Acid–Base titrations: Strong acid–Strong base, Weak acid–strong base, Weak acid Weak base titration, Displacement titrations, polybasic acid titrations. (Discuss titration with respect to neutralization and equivalence point determination and limitations)

Redox titrations: Principle of redox titration, detection of equivalence point using suitable indicators.

Complexometric titrations: Principle, EDTA titrations, choice of indicators

Iodometry and Iodimetry: Principle, detection of end point, difference between iodometry and iodimetry, Standardization of sodium thiosulphate solution using potassium dichromate and iodine method, Applications – estimation of Cu , estimation of Cl₂.

Spectrophotometry/ Colorometry (10 periods)

Introduction, Electromagnetic spectrum, Interaction of electromagnetic radiations with the matter, Mathematical Statement and derivation of Lambert’s Law and Beer’s Law, Terminology involved in spectrophotometric analysis, Instrumentation of single beam colorimeter, Instrumentation of single and double beam spectrophotometer, Principle of additivity of absorbance and simultaneous determination, Spectrophotometric Titrations, Experimental Applications-Structure of organic compound. Concept of λ -max, Lambert-Beers law and concentration of unknown solution of

KMnO₄ in 2 N H₂SO₄, Theoretical aspect to recognize λ_{\max} and concentration of unknown solution of CuSO₄, Photometric titration viz. (Cu²⁺ ions with EDTA), To determine the indicator constant of methyl red indicator.

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Certificate, Diploma, Advanced Diploma and B.Voc Degree
(Chemical & Petrochemicals Applied Analytical Chemistry)
First Year (Semester II) Semester Pattern
Paper-IX: Petrochemistry(CPAC-09)

Maximum Marks: 100

Credits: 4

Periods-45

1. Introduction to Petrochemistry (5 periods)

2. Crude Petroleum Oil: (10 Periods)

Composition, Hydrocarbon Groups, Complex Hydrocarbons, Non-Hydrocarbons or Hetero-Atomic Compounds, Physical Properties of Crude Oil, Origin of Hydrocarbons, Exploration Techniques, Gravimetric Method, Magnetometric Method, Seismic Survey, Remote Sensing Method.

3. Petroleum Products and Test Methods: (10 periods)

Crude Oil Analysis, API Gravity, Characterisation Factor, Bottom Sediment and Water, Domestic Fuels, Liquefied Petroleum Gas, Kerosene, Smoke Point, Flash Point, Char Point and Bloom, Distillation Test, Sulfur Content and Corrosion, Automotive Fuels, Motor Spirit, Material Distillation, Octane Number, Corrosion, Reid Vapour Pressure, Oxidation Stability, Additives, High Speed Diesel, Cetane Number, Diesel Index, Sulfur, Corrosion, Flash Point, Flame Length, Pour Point, Viscosity. Aviation Fuels, Furnace Fuels, Gaseous Fuels, Liquid Fuels, Lubricating Oils, Viscosity, Saybolt Method, Redwood Method, Brookfield Method, Viscosity Index, Cloud Point, Pour Point, Miscellaneous Products: Jute Batching Oil, Mineral Turpentine Oil, Carbon Black Feed Stock, Bitumen, Petroleum Coke, Wax.

4. Lubricating Oil and Grease: (10 periods)

Components of Finished Lubricating Oils, Automotive Oils, Industrial Lubricants, Bearing Lubricants, Hydraulic Lubricants, Compressor Lubricants, Pump Lubricants, Aviation Lubricants, Marine Lubricants, Greases, Lube Blending and Grease Manufacture, Environmental Impact of Lubricants, Reclamation of Used Lubricants, Power Consumption in a Blending Tank.

5. Petrochemicals (10 periods)

Definitions of Petrochemicals, Feedstocks, Intermediates, Finished Products, Naphtha Cracking, Primary Fractionator or Stabiliser, Hydrogen Separator, Conversion Processes for Selected Petrochemicals, Polyethylene, Polypropylene, Polyethylene Terephthalate, Polyvinyl Chloride, Polystyrene, Polybutadiene, Acrylonitrile Butadiene Styrene, Styrene-Butadiene Rubber, Poly Methyl Metha Acrylate, Polytetrafluoroethylene, Nylons, Phenol Formaldehyde, Urea Formaldehyde, Melamine Formaldehyde, Polyurethane, Toluene Diisocyanate, Silicone, Petrochemical Complex, Processing of Plastic, Rubber, and Fibre, Moulding of Plastics, Extrusion Moulding, Blow Moulding, Compression Moulding, Thermal Moulding, Injection Moulding, Rubber Compounding.

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First Year (Semester I) Semester Pattern
Paper-X: Laboratory Course-IV (CPAC-10)

Maximum Marks: 150

Credits: 6

Periods-90

- 1 Determination of Hydrochloric acid content in drug substance by titrimetric method.
- 2 Identification of active drug substance in sample matrix by colorimetric method
- 3 To determine the chloride content from drinkable water by titrimetric method
- 4 Hands on UV- Visible spectrometer.
- 5 Demonstration and working of HPLC.
- 6 Hands on FT-IR Spectrophotometer for drug substance.
- 7 Measurement of refractive index of Water and glycerol
- 8 Determination of Optical rotation using Polarimeter.
- 9 Acid-base titration using Autotitrator.
- 10 Find out Loss on drying of sample.
- 11 Preparation and standardization of volumetric solutions like 0.1N HCl, 0.1N NaOH, 0.01M $\text{Na}_2\text{S}_2\text{O}_3$.
- 12 Estimate the amount of lead and tin from solder alloy
13. Estimate the amount of Copper and zinc from brass alloy

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Paper-XI: Laboratory Course-V (CPAC-11)

Maximum Marks: 150

Credits: 6

Periods-90

Organic qualitative analysis of binary mixture (**Minimum 8** mixtures with one liquid-liquid)

Inorganic qualitative analysis of binary mixture (**Minimum 8** mixtures)

Graphical representation using Microsoft excel (Any 4)

Applications of Chem-sketch in structure drawing. (**Any 4** practical's)

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First Year (Semester I) Semester Pattern
Paper-XI: Laboratory Course-V (CPAC-11)

Maximum Marks: 150

Credits: 6

Periods-90

Project/Industrial Training or Visit

References:

- Longman Dictionary of Common Error-, N. D Turton, J. B Heaton (Pearson, 2004)
Polymeric Materials, C. C. Winding and G. D. Hiatt McGraw Hill Book Co. Polymer Science
by Gowarikar
Polymer science, Bill Meyer, F. W. Jr. John Wiley & sons
Essentials of Physical Chemistry by B.S. Bahl, G.D.Tuli and ArunBahl Edition 2000 S.
Chand and Company Ltd
Principles of Physical Chemistry, Fourth Edition by S.H. Marron and C. F. Pruton
Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar
Analytical Chemistry by Skoog
Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel
Vogel's textbook of Quantitative Inorganic Analysis-4th edition
Instrumental Methods of Chemical Analysis- Chatwal and Anand
Lehninger's, Principles of Biochemistry, by Nelson and Cox Macmillan Publisher 4thEdn.
Harper's Illustrated Biochemistry, 26th Edition.
Basic Organic Chemistry, Jonathan N Clayden, 2nd Edition.
Fundamentals of Petroleum and Petrochemical Engineering by Uttam Ray Chaudhuri